# FIELD BIOLOGY OF *NESOKIA INDICA* WITH REFERENCE TO ORCHARDS OF BALUCHISTAN (PAKISTAN)[1]

AFSAR MIAN[2]

The biology of 122 individuals of *Nesokia indica* trapped from orchards of Quetta, Pishin, Zhob, Loralai and Khuzdar is analysed from distribution of age structure, sex and reproductive parameters in three seasons (autumn, winter and spring). The results indicate that the population is balanced with regard to sex, though males/females in higher age classes show differential activity levels. Females are reproductively active throughout the year with a reproductive peak in spring and summer. The species appears to be a less prolific breeder in the area.

## INTRODUCTION

The Short-tailed Bandicoot Rat or the Short-tailed Mole Rat, *Nesokia indica* Gray and Hardwicke, 1852, is known from various distributional and biological notes from Iran (Lay 1967), Iraq (Walker *et al.* 1964), southern Sind (Wagle 1927, Fulk and Khokhar 1977), and Faisalabad (Taber *et al.* 1967, Begum and Beg 1980, Roberts 1977). Roberts (1974) associated this species with irrigated plantations. Apropos to our survey of the vertebrate pests of orchards of Baluchistan, which indicated that *N. indica* is a significant pest to orchard plantation in highland desert valleys (Mian *et al.* 1988a, 1988b), we became interested in the ecology of the species, which has been neglected in the area. The paper attempts at reporting some preliminary data on the biology of this important pest with relevance to Baluchistan (Pakistan).

## MATERIAL AND METHODS

122 individuals of *N. indica* were captured between October, 1983 and May, 1984 from orchards of Quetta (74), Khuzdar (1), Kuchlag (12), Pishin (11), Bund Khushdil Khan (2), Gulistan (14), Zhob (7), and Loralai (1) by steel snap traps (size 17.5 × 9.5 cm.) baited with pieces of apple. Each of the trapped animals was injected 1-5 ml of commercial grade formaline (saturated solution of formaldehyde) through intraperitoneal route. Different samples were bagged in cellophane bags and brought back to the laboratory for further analysis. As all the individuals were collected from the areas sharing similar physical and biotic conditions, the data was pooled for further analysis of various biological parameters of the species concerned in relevance to orchards of the highland deserts of Baluchistan.

Each individual was sexed and weighed (up to 0.1 g by using Ohios single pan balance). The data was analysed for the distribution of males and females in different regional/seasonal samples and in different age groups. The weight classes, representing different ages (juvenile, less than 80 g; early adult, 81-130 g; adult 131-170 g; older adult, more than 170 g) were adopted from Begum and Beg (1980). Each female was checked for open/plugged nature of vagina, for spotting any recent mating. The uteri were physically examined for pregnancy status and for uterine

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[1] Accepted February 1986.

[2] Department of Zoology, University of Baluchistan, Quetta, Pakistan. *Present address*: Bahauddin Zakaria University, New Campus, Multan, Pakistan.

scars, as an indication of recent pregnancy. The embryos, wherever present, were weighed upto 0.1 g. The number of mammary glands and their lactating status was recorded visually. In males, the gonadal status was recorded.

Statistical analysis was carried out following appropriate methods outlined by Sokal & Rohlf (1969).

## RESULTS

(1) *Sex Ratio*: Table 1 presents data regarding the distribution of males and females in different areas, seasons, age classes and in the overall sample of the species. The sex ratio of 1:1 is maintained in the overall sample of the species. The data suggests that except for Loralai and Khuzdar (very low trap success indicating a very low population level), the population is balanced with respect to the distribution of the two sexes in different geographic localities. It is also obvious that a normal sex ratio is maintained in the three seasonal samples (autumn, winter, spring). The males and females appear to be equally distributed in juvenile and early adult classes; however, the sex ratio is grossly skewed in the two higher age classes, i.e., adults (in favour of females) and older adults (in favour of males).

TABLE 1

DISTRIBUTION OF MALES AND FEMALES IN *N. indica*, SAMPLED FROM DIFFERENT AREAS, SEASONS AND IN DIFFERENT AGE CLASSES

| | | Male | Female | Sex ratio (Male: Female) |
|---|---|---|---|---|
| Area | Quetta | 33 | 41 | 0.80:1 |
| | Pishin | 23 | 16 | 1.44:1 |
| | Zhob | 5** | 2** | 2.50:1 |
| | Loralai | — | 1* | — |
| | Khuzdar | 1* | — | — |
| Season | Autumn | 22 | 26 | 0.85:1 |
| | Winter | 22 | 17 | 1.29:1 |
| | Spring | 16 | 19 | 0.84:1 |
| Age Class | Juvenile | 7 | 4 | 1.75:1 |
| | Early Adult | 22 | 24 | 0.92:1 |
| | Adult | 14† | 25† | 0.56:1 |
| | Older adult | 19†† | 7†† | 2.71:1 |
| Total | | 60 | 62 | 1.03:1 |

*Number of specimens trapped is low and hence cannot be subjected to statistical analysis.

**Not significant using Yate's correction for continuity.

†Chi$^{2}$($_{1}$) = 3.1026 ††Chi$^{2}$($_{1}$) = 5.4146.

(2) *Age Structure*: The distribution of different age classes in three seasonal, and the pooled, samples is presented in Table 2. It suggests the relative preponderance of early adult (37.72%), adult (30.06%) and older adult (22.47%) classes and a relative scarcity of juveniles (9.75%), in the total sample. However, it appears that there is a gradual increase in the representation of juvenile class from autumn (5.41%) to winter (9.57%) and spring (14.29%). A similar trend seems to be followed in the class, represented by 19.41%, 30.29% and 40.48% in autumn, winter and spring respectively. The early adult class dominates the autumn (50.73%) and winter (51.00%) samples, but its representation decreases sharply in spring (11.43%). The proportionate representation of the older adult class has a marked decrease in winter sample (9.14%).

(3) *Reproduction*: The data on the reproductive status of 60 females, in different seasons and age classes, is presented in Table 3. The table suggests that females with visible pregnancy are present in all the seasonal samples, suggesting that females remain sexually active throughout the year. However, there is a higher proportion of the females with visible ovaries in spring (69.3%), followed by winter (46.0%) and autumn (7.5%). Similarly, the proportion of females with visible signs of

TABLE 2

DISTRIBUTION OF FOUR AGE CLASSES (PERCENTILE) IN DIFFERENT SEASONS IN *N. indica*

| Season | No. | Age class<br>Juvenile | <br>Early Adult | <br>Adult | <br>Older Adult |
|---|---|---|---|---|---|
| Autumn | 48 | 5.41 | 50.73 | 19.41 | 24.45 |
| Winter | 39 | 9.57 | 51.00 | 30.29 | 9.14 |
| Spring | 35 | 14.29 | 11.43 | 40.48 | 33.82 |
| Total | 122 | 9.75 | 37.72 | 30.06 | 22.47 |

TABLE 3

DISTRIBUTION OF DIFFERENT CLASSES OF FEMALES WITH REGARD TO REPRODUCTIVE STATUS IN DIFFERENT SEASONS AND AGE CLASSES IN *N. indica*

| | | Season | | | Age class | | | |
|---|---|---|---|---|---|---|---|---|
| | | Autumn | Winter | Spring | Juvenile | Early Adult | Adult | Older Adult |
| No. Examined | | 27 | 16 | 17 | 4 | 24 | 25 | 7 |
| Gonadal Status | Visible | 0.075 | 0.460 | 0.540 | 0.00 | 0.191 | 0.560 | 0.857 |
| | Invisible | 0.925 | 0.540 | 0.460 | 1.00 | 0.809 | 0.440 | 0.143 |
| Pregnancy Status | Plugged | 0.000 | 0.000 | 0.270 | 0.00 | 0.000 | 0.080 | 0.143 |
| | Visible Pregnancy | 0.090 | 0.285 | 0.110 | 0.00 | 0.048 | 0.200 | 0.286 |
| | Scars | 0.335 | 0.105 | 0.110 | 0.00 | 0.286 | 0.120 | 0.143 |
| | Total | | | | 0.00 | 0.334 | 0.400 | 0.572 |
| Av. No. Embryos | | 3.5 | 2.5 | 4.00 | | | | |
| Av. No. Scars | | 4 | 4 | 4 | | | | |
| Av. Weight of Embryo (g) | | 5.80 | 7.15 | 1.37 | | | | |

pregnancy (pregnant or plugged) gradually decreases from spring (38.7%) to winter (28.5%) and autumn (9.5%). A higher proportion of the females of spring sample (27.7%) bore vaginal plugs, whereas none was seen in winter or autumn. All these collectively indicate that the species is reproductively more active during summer and least in autumn. The higher percentage of the females of autumn sample (33.5%) showing uterine scars, also suggests the presence of a higher reproductive activity during the previous summer.

A higher proportion of the females with visible pregnancy is present in winter sample (28.5%) as compared to spring (11.0%) or autumn (9.5%).

The average number of embryos per pregnant female was the minimum in winter sample (2.5), followed by autumn (3.5), and was highest in spring (4.0). The average weight of the embryo exhibits a reverse pattern, being highest in winter (7.15 g), followed by autumn (5.8 g) and lowest in spring (1.37 g). The average number of the uterine scars, however, remains constant in all the seasonal samples, and all the females examined constantly bore four scars.

The smallest pregnant female trapped in our sample weighed 113.0 g though a female bearing scars, showing a previous pregnancy, weighed 101.5 g. However, no female with any sign of reproductive activity is recorded in juvenile age class. Females showing sign of pregnancy constitute 20% (5.45% with vaginal plugs and 14.55% with visible pregnancy) of the overall female population. The proportion of females with visible ovaries increases from 0.00% in juvenile class to 19.05%, 56.00% and 85.71% in early adult, adult and older adult classes respectively. Similarly, the proportion of females showing signs of reproductive activity (with vaginal plugs, visible pregnancy or uterine scars) increases from 0.00% to 33.33%, 40.00% and 57.15% in different, progressively increasing age classes. Females showing signs of pregnancy also increase from 0.00% in juvenile class to 4.76% in early adult, 28.00% in adult and 42.86% in older adult classes.

## DISCUSSION

(1) *Sex Ratio*: The sex ratio of 1:1 maintained in the overall population as well as in regional and seasonal samples, suggests that the population is balanced with regard to distribution of males and females, and no behaviourial sexual dimorphism exists in this species. The presence of skewness in favour of females in adult and in favour of males in older adult classes can be explained on the basis of a differential behaviour and/or activity of the members of the two sexes at different ages. Further studies are required to prove this hypothesis, which suggests that females are more active in adult and males in older adult classes. Such a difference in activity of the two sexes has been previously reported for a number of rodent species (Shadown 1963, Faust *et al.* 1971, Bigler and Jenkins 1975, Rana and Beg (1976), though Fisler (1971) could not find any difference in the level of activity of the two sexes of *Reithrodontomys* sp. at any reproductive stage.

(2) *Age Structure*: The general paucity of juveniles in our samples suggests a tendency of their staying in and/or around their maternal burrows, rendering them less vulnerable to trapping. The fact that the smallest individual trapped weighed 37.4 g, and that most of the juveniles in our samples weighed between 60 g and 90 g, yields some degree of support to the hypothesis. Though more data is needed on the home range, such a phenomenon has been reported to cause sampling artifact in other rodent species, like *Rattus* sp. (Harrison 1966), *Bandicota bengalensis* (Spillett 1968), and *Mus musculus* and *M. booduga* (Rana and Beg 1976).

The shift in the age structure during different parts of the year can be conveniently explained on the basis that the maximum reproductive activity and recruitment of the new individuals in the population occur during spring and summer, and death of the individuals of older classes during winter.

(3) *Reproduction*: The presence of reproductively active females in all the seasonal samples suggests that *N. indica* remains reproductively active throughout the year, generally agreeing with previous observations (Faisalabad, Punjab — Taber *et al.* 1967, Iran — Lay 1967, Punjab, Pakistan — Roberts, 1977, Iraq — Walker *et al.* 1964). However, it appears that the species is reproductively most active during spring, followed by winter, and is least active in autumn. The high proportion of females with vaginal plugs in the spring sample, and uterine scars in autumn also suggest maximum mating and pregnancy rate in spring/summer.

A higher proportion of the females showing pregnancy in the winter sample, appears hard to explain in the wake of extreme environmental conditions of temperature, snowfall/rainfall and scarcity of vegetation. Further, a relative scarcity of females bearing scars in the spring sample also indicates scarcity of pregnant females in winter. It appears that the preponderance of pregnant females in the winter sample is caused by higher activity level of these females, as may be needed for higher energy requirements of this predominantly herbivore rodent. If further studies prove our hypothesis, then trapping in the orchards, having comparatively better vegetation, may deprive the species of the potential recruits, causing a greater damage to the species.

The presence of only four scars in all the females and a single reproductive episode suggest that, on an average only one litter is produced per female per annum. This is in sharp contrast to observations of Fulk and Khokhar (1977) from southern Sind, where up to 21 scars have been recorded in some females, corresponding to five average litters. The present data on the number of foetuses per pregnant female agree with the one collected from Iran (Llyod 1909), though it remains below that recorded by Roberts (1977) for Punjab. The corroboration of the data on the uterine scars and average number of foetuses allows us to suggest that, in this region females initially implant four embryos. Some of these embryos are then flushed out, maximum flushing occurring in winter (1.5 per female), followed by autumn (0.5) and virtually no flushing out of the embryos occurs in spring. It appears that harsh environmental conditions in winter forces a maximum flushing out of the embryos, while optimal conditions in spring allow the development of all the embryos. Further studies are needed to know the significance of such a reproductive behaviour of the species.

The pattern of annual recruitment and production of reproductively active individuals in spring/summer fully conforms with the vegetative cycle of the area, suggesting that this predominantly herbivore species is fully adapted to the area. The presence of only one reproductive peak, fewer number of foetuses, and only 20% of the females showing signs of reproductive activity, all suggest that the species is not a very prolific breeder in the area, which agrees with the previous observations from other parts of its range (Roberts 1977).

The fact that none of the juvenile individuals (weighing less than 80 g) exhibited any sign of reproductive activity agrees with previous reports (Begum and Beg 1980, Fulk and Khokhar 1977).

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